

## HR-225 Characterization of Fly Ash for Use in Concrete

**Key Words:** Fly ash characterization, Portland cement concrete, PCC

### ABSTRACT

Recent construction of new generation power plants burning western coal within Iowa has resulted in fly Ash production on the order of 760,000 tons annually. Although fly ash has long been accepted as a valuable replacement for portland cement in concrete, most experience has been with fly ash generated from eastern bituminous coals. A few years ago, fly ash in Iowa was not a significant factor because production was small and economics dictated disposal as the better alternative than construction use. Today, the economic climate, coupled with abundance of the material, makes constructive use in concrete feasible. The problem is, however, fly ash produced from new power plants is different than that for which information was available. It seems fly ash types have outgrown existing standards.

The objective of this study was to develop fundamental information about fly ashes available to construction in Iowa such that its advantages and limitations as replacement to portland cement can be defined. Evaluative techniques used in this work involve sophisticated laboratory equipment, not readily available to potential fly ash users, so a second goal was preliminary development of rapid diagnostic tests founded on fundamental information. Lastly, Iowa Department of Transportation research indicated an interesting interdependency among coarse aggregate type, fly ash and concrete's resistance to freeze-thaw action. Thus a third charge of this research project was to verify and determine the cause for the phenomena.

One objective of this project was to determine properties of Iowa fly ashes and evaluate their relevance to use of the material as an admixture of PCC. This phase of the research involved two approaches. The first involved the development of a rapid method for determining quantitative elemental composition while the second was aimed at both qualitative and quantitative determination of compounds.

X-ray fluorescence techniques were adapted for rapid determination of elemental composition of fly ash. The analysis was performed using a Siemens SR-200 sequential x-ray spectrometer controlled by a PDP-11-03 microcomputer. The spectrometer was equipped with a ten sample specimen chamber and four interchangeable analyzing crystals. Unfiltered excitation radiation was generated using a chromium tube at 50 KV and 48 ma. Programs for the spectrometer were developed by the Siemens Corporation.